Item No: 0001AB

Title of the Project:

Optimization of Properties of a New Material for Electronic and Magnetic Applications

Topic No.:

Contract No.: Contract Starting Date:

Contract Ending Date:

Contractor:

BMDO 97-014

N00014-97-C-0209

May 14, 1997

December 14,1997 SKION Corporation

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Hoboken, NJ 07030

DISTRIBUTION BRATEMENT A

Agproved for public releases Distribution Unitstand

Prepared By:

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Report Date: August 14, 1997

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is maintaining the data needed, and completing and review including suggestions for reducing this burden, to Washin VA 22202-4302, and to the Office of Management and E	s estimated to average 1 hour per responding the collection of information. Send ington Headquarters Services, Directors to March Personal Property of the Collection Property of the C	onse, including the time for review comments regarding this burden is to information Operations and	ring instructions, searching existing data sources, gathering
1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE		AND DATES COVERED
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4. TITLE AND SUBTITLE Optimization of Prov	oorting of		5. FUNDING NUMBERS
Optimization of Properties of a New Material for Electronic and Magnetic Applications			Contract
			N00014-97-C-0209
6. AUTHOR(S)	" " " " " " " " " " " " " " " " " " "		-
Dr. Steven Kim			
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)			8. PERFORMING ORGANIZATION REPORT NUMBER
SKION Corporation			SKI 0002
50 Harrison Street			SKI 0002
Hoboken, NJ 07030			
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Picatinny, NJ 07086	-5000		
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ABSTRACT (Maximum 200 words)			
Several test samples were gr	own at the City Colle	ge of New York N	IBE facility. The exact
growth rate is unknown at pr	esent, but the nomina	d thickness are 12	.5, 25, and 50 nm MnAs
on 100 nm buffer layers of C	aAs.		*
The substrate orientations ar	e (001). GaAs buffer	layers are n-type	with a carrier
concentration of ~5x10 ¹⁷ cm	⁻³ and a thickness of ~	100 nm. The non	ainal growth rate of
MnAs was 50 nm/hour. Flux	x ratio of As/Mn was	about 5-10 All th	ne lavers were annealed
at 400°C for 1 minute after t			
250°C to 400°C was about 4		of increasing grow	in temperature nom
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Growth temperatures and gro		•	
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B96: 200C for 1 min.	250C for 14	min.	
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OF REPORT OF T	HIS PAGE	9. SECURITY CLASSIF	TOATION 120. CIMITATION OF ADSTRAC

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We had access to MBE facility at City College of New York. We have grown several test samples. The exact growth rate is unknown at present, but the nominal thickness are 12.5, 25, and 50 nm MnAs on 100 nm buffer layers of GaAs.

The substrate orientations are (001). GaAs buffer layers are p-type with a carrier concentration of ~5x10¹⁷ cm⁻³ and a thickness of ~100 nm. The nominal growth rate of MnAs was 50 nm/hour. Flux ratio of As/Mn was about 5-10. All the layers were annealed at 400°C for 1 minute after the growth (the time for increasing growth temperature from 250°C to 400°C was about 4 minutes.

Growth temperatures and growth times for MnAs layers are:

B94: 200C for 7 min. 30 sec. 250C for 42 min. 30 sec.

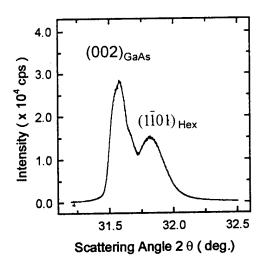
B95: 200C for 1 min. 250C for 30 min.

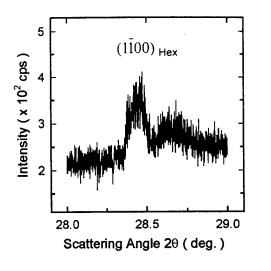
B96: 200C for 1 min. 250C for 14 min.

Next month, we will characterize the magnetic and optical properties of the samples: the effect of steady electric fields on hysteresis curves, MOKE and the index of refraction will be determined.

X-ray diffraction (XRD) spectra in θ -2 θ scan revealed that at room temperature the MnAs film have mainly hexagonal phase whose plane parallel to the surface was mostly $(1\bar{1}01)$ and partially $(1\bar{1}00)$ at room temperature. Small volume fraction of orthorhombic phase (less then 4%) was also present in the film. It may be related to ununiform internal strain existed in the film. MnAs in bulk form takes the hexagonal structure and is ferromagnetic at room temperature and exhibits a first order phase transition at 40°C to a paramagnetic state with the orthorhombic structure. It is well known the magnetic properties and structure of MnAs are highly sensitive to pressure.

Although our first film was a mixture of hexagonal phases with two different growth orientation and orthorhombic phase, it can be controlled by changing growth conditions such as substrate temperature, Mn to As flux ratio and different thickness of GaAs buffer layer. Furthermore we presented that the easy direction of magnetization in film was controlled by predepositions of different first few atomic layer before growth of MnAs.





Typical XRD spectra of MnAs film in θ -2 θ scan mode. Miller indices of scattering are shown above peaks. The most intense peak at the left hand side is related to the (002) plane of GaAs substrate.